REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, claim 15 has been added and is the sole independent claim in the application, with claim 1 being amended to be a dependent claim, dependent on claim 15. Claim 15 recites a wiring-connecting material including a polyurethane resin, a radical-polymerizable substance and a curing agent generating a free radical upon heating, with the wiring-connecting material having a flow property value, (B)/(A), of from 1.3 to 3.0, (A) and (B) being further defined. In connection with this flow property value, note, for example, the paragraph bridging pages 19 and 20 of Applicants' specification. In view of new claim 15, dependencies of various of the remaining claims have been amended. Moreover, claim 8 has been amended to be dependent on any one of claims 1-3 and 15.

In addition to new claim 15, Applicants are adding new claims 16-21 to the application. Claim 16, dependent on claim 15, further defines the flow property value, consistent with the description on page 19, lines 20 and 21 of Applicants' specification. Claims 17 and 18, each dependent on claim 15, define various properties of the wiring-connecting material consistent with the description at page 20, lines 5-20, of Applicants' specification. Claims 19 and 20, each dependent on claim 15, respectively defines the radical-polymerizable substance as being at least one selected from the group consisting of acrylates, methacrylates and maleimide compounds; and recites that the polyurethane resin is obtained by reaction of a diol with a diisocyanate. Claim 21, dependent on claim 15, defines a weight-average molecular weight of the polyurethane resin. In connection with claims 19-21, note, for example, the paragraph

bridging pages 8 and 9, the paragraph bridging pages 9 and 10, and page 12, lines 8-12, of Applicants' specification.

The objection to claims 8 and 9 under 37 CFR § 1.75(c), set forth in Item 1 on page 2 of the Office Action mailed July 7, 2003, is noted. Dependency of claim 8 has been amended, such that claim 8 is dependent on any one of claims 1-3 and 15, with each of claims 1-3 and 15 being a single-dependent claim. Accordingly, since multiple dependent claim 8 is dependent only on single-dependent claims, the objection to claims 8 and 9 as set forth in Item 1 on page 2 of the Office Action mailed July 7, 2003, is moot.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed July 7, 2003, that is, the teachings of the U.S. patents to Miyamoto, et al., No. 6,039,896, and to Wolinski, No. 3,994,764, under the provisions of 35 USC §103.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such wiring-connecting material as in the present claims, comprising components as recited therein, and wherein this wiring-connecting material has a flow property value of from 1.3 to 3.0. See claim 15.

In addition, it is respectfully submitted that the applied references would have neither disclosed nor would have suggested such wiring-connecting material as in the present claims, having the feature as discussed previously in connection with claim 15, and further wherein this flow property value is in a range of from 1.5 to 2.5 (see claim 16); and/or wherein the material includes 2 to 75 parts by weight of the

polyurethane resin, 30 to 60 parts by weight of the radical-polymerizable substance and 0.1 to 30 parts by weight of the curing agent generating a free radical upon heating (see claim 1); and/or wherein the material further includes a film-forming material, in an amount up to 40 parts by weight (see claim 2), particularly where this film-forming material is a polyimide resin (see claim 3); and/or additional properties of the wiring-connecting material as in claims 17 and 18; and/or wherein the polyurethane resin is obtained by reaction of a diol with a diisocyanate (see claim 20), or has a weight-average molecular weight in a range of 10,000 - 1,000,000 (see claim 21), or wherein the polyurethane resin has a flow point of from 40°C-140°C (see claim 5); and/or wherein the radical-polymerizable substance is at least one selected from the group consisting of acrylates, methacrylates and maleimide compounds (see claim 19), in particular, wherein the substance is urethane acrylate (see claim 7); and/or wherein the curing agent has a weight retention at 25°C for 24 hours, of not less than 20% by weight (see claim 6).

Moreover, it is respectfully submitted that these applied references would have neither taught nor would have suggested such a process for producing a wiring-connected board as in the present claims, including a connecting step, and wherein this connecting step includes the step of heating the wiring-connecting material as in any one of claims 1-3 and 15, while applying a pressure thereto via wiring members being interconnected (see claim 8); in particular, with at least one of the connecting terminals having a surface formed of at least one metal selected from gold, silver and a platinum group metal (see claim 9).

The present invention is directed to a wiring-connecting material which includes

an adhesive composition, and a method of use thereof. In particular, the invention relates to such material, having better low-temperature, fast-curing performance, which can be used for electrical connections when, for example, containing conductive particles, and a method of use thereof.

Epoxy resin adhesives have been widely used for various purposes, including electric and electronic constructs. Various film-like adhesives have been described. In recent years, however, in the field of precision electronic instruments, circuits are being made with high density, so that connecting terminals have come to be formed at a very narrow width and pitch. In view of modern requirements, it has been desired to provide a low-temperature curing, speedily curable wiring-connecting material, capable of curing at a low temperature and yet in a short time.

Against this background, Applicants provide a wiring-connecting material, and a process for producing a wiring-connected board using such material, which has improved low-temperature curing and fast-curing performance. In particular, Applicants have discovered that by providing a composition containing a polyurethane resin, a radical-polymerizable substance and a curing agent generating a free radical upon heating, and with such composition having a flow property value as in the present claims, objectives of the material having a low-temperature cure and a fast-curing performance can be achieved. That is, as long as the flow property value is 1.3 or more, the wiring-connecting material has sufficient flow properties and can achieve good connection; and as long as the flow property value is 3.0 or less, the wiring-connecting material is less likely to cause air bubbles to have a good reliability. Note, for example, the paragraph bridging pages 19 and 20 of Applicants' specification.

Thus, it is respectfully submitted that Applicants have discovered that by properly providing a specified property (that is, flow property value) of the wiring-connecting material, not focused on by the prior art, a wiring-connecting material having good properties can be achieved.

Furthermore, by utilizing a material having a temperature at which exothermic reaction rises, a peak temperature and an end temperature as in the present claims, both low-temperature connecting performance and room-temperature storage stability are achieved. Note the first full paragraph on page 20 of Applicants' specification.

Moreover, by use of a material having a storage elastic modulus as in the present claims, both reduced internal stress of the resin after connection, and improved adhesive force, and also good conduction characteristics, can be achieved. See the second full paragraph on page 20 of Applicants' specification.

Miyamoto, et al. discloses an anisotropic conductive adhesive that is used for joining minute circuits, the adhesive including conductive particles dispersed in a resin composition, the resin composition including a radical polymerization resin (A), an organic peroxide (B), a thermoplastic elastomer (C) and a phosphoric ester (D) represented by a specified formula. See column 3, lines 32-49. This patent discloses that the resin composition can further contain a specified epoxy silane coupling agent (E). See column 3, lines 52-65. This patent discloses that the anisotropic conductive adhesive can be used for electrical joining of electronic or electric parts of electrical apparatus. See column 4, lines 32-34. Note also column 4, lines 48-50; and column 5, lines 4-9 and 21-23. As for the radical polymerization resin, note column 5, lines 46-51; and as for the thermoplastic elastomer and the phosphoric ester, note

column 6, lines 19-31 and 42-50, respectively.

It is respectfully submitted that Miyamoto, et al. does not disclose, nor would have suggested, any focus on the flow property value of the anisotropic conductive adhesive described therein; much less the specific flow property value as in the present claims, and advantages thereof.

Furthermore, it is respectfully submitted that Miyamoto, et al. would have neither taught nor would have suggested the other aspects of the present invention, in the dependent claims, as discussed previously, and advantages thereof.

It is respectfully submitted that the additional teachings of Wolinski would not have rectified the deficiencies of Miyamoto, et al., such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Wolinsky discloses adhesives in which a non-reactive thermoplastic polyurethane is dissolved in an acrylic monomer and a copolymerizable carboxylic acid group-containing monomer, the solution as formed being combined with an unactivated dormant free-radical polymerization catalyst to form an adhesive, with an activator for the dormant catalyst being separately provided. This patent discloses that the activator is applied to at least one of the surfaces to be joined and the adhesive is applied to at least one of the surfaces to be joined, and the surfaces are mated and held in contact until the adhesive bond is formed. See column 2, lines 44-57. Note also column 8, lines 11-20, describing amounts of the various components in the solution of the polyurethane and catalyst in the mixture of the acrylic monomer component and the acid monomer component.

Even assuming, arguendo, that the teachings of Wolinski were properly

combinable with the teachings of Miyamoto, et al., such combined teachings would have neither disclosed nor would have suggested the present invention, including flow property value, much less the specific flow property value of the wiring-connecting material as in the present claims and advantages thereof.

The contention by the Examiner in Item 5 on page 3 of the Office Action mailed July 7, 2003, that Wolinski discloses an adhesive including polyurethane, radical-polymerizable substance and curing agent in the amounts specified in claim 1, the Examiner referring to Example 1, is noted. Note that Example 1 describes an adhesive having specific amounts of a polyester-based urethane resin dissolved in a mixture of the same amount of acrylic acid and a little bit more methylmethacrylate. The composition also including benzoyl peroxide and hydroquinone, in specific amounts. This Example indicated that an activator (that is, dimethyl aniline) dissolved in methanol to form a 10 weight percent solution, was also used. It is respectfully submitted that this disclosure in Example 1 does not indicate any flow property value for the described material; and it is respectfully submitted that this reference, even in Example 1, does not focus on flow property value as a property to be considered for providing a wiring-connecting material, much less the specific flow property value as in the present claims, and advantages thereof.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account No. 01-

2135 (Case No. 1303.41199X00, previously 566.41199X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

William I. Solomon
Registration No. 28,565

1300 North Seventeenth Street
Suite 1800
Arlington, VA 22209
Tel.: 703-312-6600
Fax.: 703-312-6666
WIS/sjg